VII. *On the Origin and Ancestral Form of Myrmecophilous* Coleoptera. By H. St. J. Donisthorpe, F.Z.S.

[Read April 7th, 1909.]

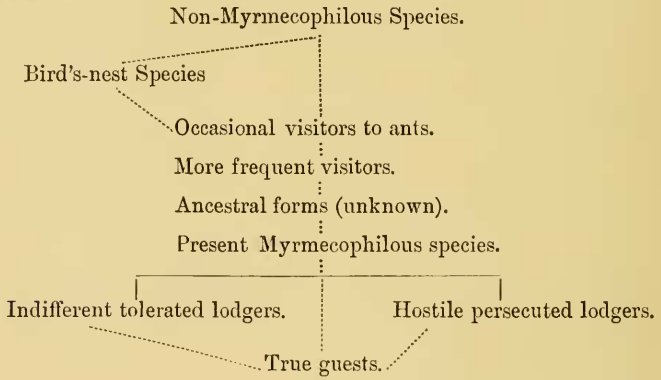
I am working at a paper on how the eggs of Myrmecophilous Coleoptera get laid in new ants' nests, which I hope to publish soon; but it occurred to me that it might be as well to publish first, as a preliminary paper, some notes on how beetles first acquired the myrmecophilous habit—that is to say, on the origin of the ancestral form of ants'-nest beetles. Of course the ancestral form of any species of truly Myrmecophilous Coleoptera is lost, and unknown to-day, but it appears to me that by studying the habits of those species which are occasionally and not always found with ants, but more generally elsewhere, we may learn how the ancestral forms of regularly myrmecophilous beetles first acquired their present habit of life. When we speak of the ancestral form here, we do not mean that of the present known ants' guests, but of the Myrmecophilous habit itself, and the probable or possible ancestral form of future generations of those species which this paper embraces.

* It is of course quite certain that the ants must have been evolved long before their guests, and granted this, then the guests themselves must have acquired their habit by degrees, by developing and using the different means, we see to-day in the regular guests, of defence against the ants, and to please and be of use to them. If we study the species about to be mentioned we shall see they exhibit great variety both in the extent to which they are found with ants, and also in their relations to their hosts. Some have advanced much further along the road towards being regular guests. Even in the true myrmecophilous species, we can trace to-day evolution and development at work—for example the forms or races of *Dinarda* in relation to their different hosts (Zool., 1908, pp. 68–71), the development of *Hetaerius* into a true guest from being

* See "Some Notes on Myrmecophilous Spiders." Donisthorpe, Zool., 1908, p. 420.

an indifferently treated lodger (Wasmann, Zeitsch. f., wissenschaft, Insekten, 1905, Heft 8, p. 330, and Wheeler, New York Ent. Soc., 1908, iii, p. 135, etc.). There is also a wonderful beetle, *Myrmechusa mirabilis*, described by Father Wasmann, which is intermediate between the genera *Lomechusa* (true guests), and *Myrmedonia* (hostile persecuted lodgers). This looks as if a *Myrmedonia*-like species had acquired some of the habits, hairiness, etc., of a *Lomechusa*.

The following table may represent the evolution of the myrmecophilous species, according to the facts and views expressed in this paper.



I will now deal with the species of Coleoptera which are occasionally, or often found with ants, or in ants' nests in Britain, but more generally away from them, and give all the records and evidence, on such occurrences, of which I am aware, of each of them.

Aleochara ruficornis, L.

This species is widely distributed in Britain, but always rare. Janson (Ent. Ann., 1857, p. 93) writes—"I have likewise taken, by brushing herbage in the neighbourhood of the nests of *Formica fusca*, the rare *Aleochara ruficornis*, and have little or no doubt it is a truly myrmecophilous insect, although not hitherto recorded as such." Again (*l. c.* 1858, p. 81)—"Dr. Power found, this spring, an individual of this scarce species, beneath dead leaves, in the vicinity of a nest of *Formica rufa*, a few yards distant

from the spot in which I captured the specimen mentioned in last year's Annual." Fowler (Col. Brit. Isles, ii. 1888, p. 11)—"In moss near nests of *Formica rufa* or *fusca*, by sweeping, running on pathways, etc." Linnell (Reigate List, 1898, p. 5) records it "In a sandpit at Redstone near nests of *Formica rufa*."

I took it in the runs of *Lasius fuliginosus*, in company with several species of *Myrmedonia*, at Wellington College, in September, 1905.

"Occurs in moss near nests of *Formica rufa* in Bishop's Wood, Truro" (Vic. Hist. Cornwall, 1906, p. 190).

"Near nests of *Formica rufa* and *F. fusca*, Charlton" (Vic. Hist. Kent, 1908, p. 131).

We thus see that this species shows a partiality towards the company of ants, which may represent the first steps towards a regular myrmecophilous habit.

Microglossa pulla, Gyll.

This widely distributed species is recorded by Fowler (*l. c.* p. 24). "In holes of the sand-martin, etc., occasionally by sweeping, also in carrion . . . Mickleham in company with *Formica fuliginosa* (Power); . . . according to Mulsant and Rey it is found in old trees with ants and also in the nests of finches and quails, and with hedgehogs." The records with sand-martins may refer to *M. nidicola*. Brewer took it in a nest of *L. fuliginosus* in Headley Lane. It is certainly frequently associated with *Lasius fuliginosus*, in the nests of which ant I always took it at Oxshott in the spring and autumn, and also at Wellington College, where Dr. Joy has likewise met with it. It is found right in the nest of the ants. Father Wasmann gives *L. fuliginosus* and *brunneus* as its hosts, but remarks that it is more or less doubtful if it should count as truly myrmecophilous (Krit. Verz. d., Myr. *u.* Ter. Art., 1894, p. 71), and gives it as the regular guest of *L. fuliginosus* in Dutch Limburg in April and October (Tijdschr. voor Entom., xxxiv, 1891, p. 60).

Dr. Joy, in a valuable paper on Coleoptera occurring in the nests of Mammals and Birds (E. M. M., 1907, p. 240), writes of this beetle—"This species, I discovered last year, is specially attached to the nests of tits, flycatchers, etc., and this year I have been able to trace its life-history, at any rate in part. I have taken it also on several occasions in the fresh nests of the starling. The beetle enters the

nest as soon as the bird begins to build, about the middle of April, and when the full clutch of eggs is laid, about three weeks later, as many as thirty or more specimens may often be found in a single nest. It is, in fact, quite a common species, as I have only once failed to find it in the nest of a tit, a bird familiar enough in any wooded district. I have not succeeded in finding the beetles pairing, but no doubt the eggs are laid soon after the nest is entered, for when it is examined immediately after the young have flown a large number of fully grown larvae may be shaken out of it; this would be about a month after the last bird's egg is laid. Shortly after this the larvae congregate into a suitable spot (under the lid of a nesting-box in one case, and at the very bottom of a nest in another), and there spin small whitish cocoons packed together in the same plane. The insect remains in the pupal stage for about sixteen days, and then, when properly mature, eats its way out of its cocoon and immediately leaves the nest. It is hard to guess what is the history of the imago after this. Certainly it is found not very rarely on carrion, etc., and there may be a second brood produced in such situations; but I am inclined to think that this is not the case, but that the beetles hibernate till the following spring." I have thought it best to quote word for word what Dr. Joy has written about this and the next species, and then discuss its relation to our subject.

Microglossa gentilis, Märk.

"Found by Mr. F. Smith, at Hampstead, in company with *Formica fuliginosa*" (Janson, Ent. Ann., 1860, p. 101).

Crotch recorded it in nests of the same ant at Cambridge and Weston-super-Mare (Zool., 1862, p. 8139), E. C. Rye mentions that it was taken commonly by Power at Birdbrook, and by Brewer and Power at Mickleham, always with *Formica fuliginosa* (Ent. Ann., 1866, p. 49).

Fowler (*l. c.* p. 25) writes—"In the runs of *Formica fuliginosa;* rare, but probably often overlooked, as it doubles itself up and will lie for a quarter of an hour without stirring; . . . Dr. Power has taken it in considerable numbers by carefully blowing away the sand, and watching the ant-runs." B. G. Rye found it in numbers in a nest of *Lasius fuliginosus* at Brent Knoll in Somerset in 1897. I have taken it in some numbers in a nest of

Lasius fuliginosus at Oxshott in February, March, and April. Harwood recorded it with the same ant at Colchester (E. M. M., 1899, p. 72). "In the company of ants, Bishops Wood, Truro" (Vic. Hist. Cornwall, 1906, p. 190).

Joy (*l. c.* p. 241)—"This is the characteristic beetle of the owls' nest, where it may be found at any time of the year, and I have twice taken single specimens in starlings' nests. Although it has been before taken in owls' nests, it is better known as the occasional inhabitant of the nest of *Lasius fuliginosus*. *Microglossa pulla* has also the double habitat; in the case of the latter there can be little doubt that the chief host is a bird, and I think it is also with *M. gentilis*. However, it is a curious fact that *M. gentilis* has the habit, like a *Myrmedonia*, of curling itself into the shape of an S and lying 'possum' for a long time, and it is fairly commonly found in the ants' nest. *M. pulla* has also this habit, but it is not so pronounced, and it is a more irregular visitor to the ants' nests." He then proceeds to point out that *M. nidicola*, the sand-martins' nest species, and which has not been found with ants either here or abroad, has not the habit of curling up, but always runs away when disturbed; these facts also bear out my own experience.

Father Wasmann gives *Lasius fuliginosus* as the normal host of this species, and as the regular guest of this ant in Dutch Limburg, where he took it in March, April, May, June, July, September, October and November. It thus appears that it cannot be the same specimens of these two beetles which are found in the birds' nests and the ants' nests, as we see that they are found at the same time in both, and are therefore not double hosted in the sense that they pass one part of their life with the one and the rest with the other. It looks as if at some distant period two sets of their ancestors had branched off into different modes of life; it might be that a bird's nest was in the tree inhabited by ants, and the beetles found it a congenial atmosphere, and then inherited the habit to seek birds' nests, others remaining myrmecophilous.

Again, the more pronounced myrmedonia habit of the more regular inhabitant of ants' nests is very suggestive. *M. pulla*, however, may have chosen birds' nests at an earlier period, and may be losing the habit as it becomes more fixed as a birds'-nests species. On the other hand, as other species in the genus *Microglossa* are found almost

exclusively in birds' nests, the myrmecophilous habit may be the more recent, and *M. pulla* have taken to it more recently than *M. gentilis*.

Oxypoda haemorrhoa, Mann.

This little beetle, which is widely distributed, is found "in moss, haystack refuse, etc.; also found frequently in nests of *Formica rufa*" (Fowler, *l. c.* p. 35). It has been recorded with *F. rufa* from Guestling (Collett); Colchester (Harwood); Hampstead and Highgate (Janson); Erith (Waterhouse); Wellington College, Bradfield, etc. (Joy); Wigmore Woods (Walker); Bentley Woods (Morley); Egbaston and Sutton (Blatch); Knowle (Ellis); Scarborough (Wilkinson); Corbridge-on-Tyne and Chopwell Woods (Bagnall); Scotland, "in nests of *F. rufa*," local Forth, Dee and Moray (Sharp, Scot. Nat. ii. 1873–4, p. 191); Aviemore (Beare). I have taken it with the same ant at Weybridge, New Forest, etc., with *Lasius fuliginosus* at Weybridge, with *Formica exsecta* at Bournemouth in some numbers, and with *F. sanguinea* at Nethy Bridge, Inverness-shire.

Wasmann gives *F. rufa*, *pratensis*, *truncicola*, and *exsecta* as its normal hosts. Although often occurring without ants, still I think this insect has firmly established itself as an ants' nest species, in spite of the fact that some one told me a little while ago that because it was abundant in his garden in London, it could have nothing to do with ants.

Myrmedonia havorthi, Steph.

"Very rare; in company with *F. fuliginosa*; taken in the vicinity of the nests by sweeping, also from under dead leaves and moss" (Fowler, *l. c.* p. 55). Mr. Gorham took a specimen with *Lasius fuliginosus* near Southend, he lost the tube it was in, and went back to the nest and found another specimen. Most of the few recent captures have been taken running on paths, etc.

Myrmedonia collaris, Pk.

Fowler writes (*l. c.* p. 56)—"In company with various ants, or in their vicinity, at roots of grass, in moss, etc., in marshy places; it does not, however, appear at all certain that this and the preceding are necessarily associated with

ants." These two species, in common with the other *Myrmedonias*, feed on ants. Mons. L. Mesmin records that a specimen of *collaris* he put into a bottle with two ants, immediately seized and killed one of them (E. M. M., viii, 1876, p. 64). Wasmann writes—"The species of the Genus *Zyras* (*haworthi*, Steph., and *collaris*, Pk.) are indeed like *Myrmoecia*, *Myrmedonia* and *Astilbus*, ant-eaters, and live in preference in the neighbourhood of ants. As regular myrmecophiles they are, however, not to be counted. The same of *Myrmedonia limbata*." I took *M. collaris* and its larvae in some numbers in a nest of *Myrmica laevinodis* in Wicken Fen. The nest was in a heap of cut sedge, and contained ♀♀, many ☿☿, larvae and pupae, and the beetles and their larvae were in the nest among the ants.

This species is often found in moss and sphagnum, but ants often occur in such places, and as the beetles feed on ants they require to be near their nests. We can see how these two beetles, feeding on ants, and living in the neighbourhood of ants' nests, might become more regular inhabitants of the nests like the other *Myrmedonias*, some of which, *M. humeralis* for example, is often found in the runs and outside the nests.

Myrmedonia limbata, Pk.

"In nests of *Formica flava* and *fusca*, and has also been recorded as associated with *F. fuliginosa;* also found under stones, in moss, etc., near the nests" (Fowler, *l. c.* p. 56).

It has been taken with *Lasius fuliginosus* at Chobham (Saunders); Guestling (Collett); Croydon (Shepherd); Wellington College (Joy); with *Lasius flavus* at Dover (Morley); Guestling (Collett); Chattenden and Oxford district (Walker); Northumberland (Bold); Scotland, Tweed (Sharp); with *Formica fusca* in Kent (Shepherd); in ants' nest in moss, Lundy Island (Joy); in ants' nests, Isle of Man (Bailey).

I have taken it with *Formica sanguinea* at Woking, with *Lasius fuliginosus* in plenty at Wellington College, with *Myrmica scabrinodis* at Doddington, Kent, and Bembridge, Isle of Wight, and in nest of a *Myrmica* at Cannock Chase. I found in my experiments with this species it was not able to defend itself against the ants as perfectly as the more regular nest-frequenting *Myrmedonias* do. We

will discuss this more fully when we have dealt with *Astilbus*. I pointed out ("Some Experiments with Myrmecophilous Coleoptera," Ent. Rec., 1901, p. 351) that "This beetle exhibits an exactly parallel case to *Astilbus*. It will be remembered they are not so truly myrmecophilous (not invariably being found with ants) as are the other species of *Myrmedonia*."

Astilbus canaliculatus, F.

This very widely distributed species is found "In runs of *Formica flava* and other ants, also under stones in haystack refuse, decaying seaweed, moss, etc." (Fowler, *l. c.* p. 59). It also feeds on ants. Bold in 1848 wrote—"Often tenanting the nests of ants, and preying on the inmates" (Col. North. and Durham, p. 134). Messrs. Lucante and Bleuse recorded that it captured and killed ants (E. M. M., 1876, xiii, p. 65). I took a specimen at Chiddingfold running with a dead *Myrmica* in its mouth, and Walker took it under similar circumstances at Tubney. I have kept specimens alive for months in small plaster nests by giving them ants out of my different observation nests, which they always devoured. It has been recorded with *Lasius flavus* at Mickleham (F. Smith); with *Lasius fuliginosus* at Chobham (Saunders); Wellington College (Joy); Guestling (Collett); with *Formica rufa*, Chobham (Saunders); Scotland (White); with *Myrmica lacvinodis*, Guestling (Collett); in ants' nests, Isle of Man (Bailey); Lundy Island (Joy).

I have taken it with *Lasius flavus* at Sevenoaks, Hastings, Eastbourne, Portland, etc.; with *Formica sanguinea* at Weybridge; with *F. fusca* and *L. niger* at Portland; and with *Leptothorax acervorum* at Fairlight, etc., etc. In experimenting with the defence of this beetle against ants (*l. c.*), I found that if an ant was forced to seize an *Astilbus* it does not let go, as with *Myrmedonia*. The *Astilbus* exhibits the same form of defence (*i. e.* thrusting the tail in the ant's face and giving off the *Myrmedonia* smell), but it is evidently not so perfectly developed. We can imagine, that as it developed the glands which secrete the smell given off, it would be able to inhabit the nests with greater impunity and gradually to become a more regular guest. No doubt some such steps as these have taken place with the other *Myrmedonias*.

Callicerus rigidicornis, Er.

This species which, though rare, is very widely distributed, has not heretofore been regarded as myrmecophilous. It has, however, been taken with *Lasius fuliginosus* at Chobham (Saunders) and Wellington College (Joy); in the runs of *Formica rufa* at Woking in 1907 and 1908 (Champion); and I have taken it with *Lasius niger* in the New Forest. My friend, Dr. Joy, having taken it on various occasions with *L. fuliginosus*, tells me that, from its behaviour with the ants he considers it shows true Myrmecophilous habits. This looks as if the species is taking the first steps towards a myrmecophilous life.

A species of *Callicerus* is recorded with *Aphaenogaster barbara* in Palestine.

On the genus *Homalota*, Father Wasmann writes—"Many species of the Genus *Homalota* (in the old sense) live as occasional guests with ants, especially with *F. rufa*, and still more with *L. fuliginosus*. Most often one finds *Liogluta nitidula*, Kr., with the last genus."

Homalota nitidula, Kr.

"Occasionally in the nests of *F. fuliginosa*, also in dead birds" (Fowler).

"The type of this species occurs very rarely in the South of England, sometimes in the nest of *Formica fuliginosa*" (Sharp, Trans. Ent. Soc. Lond., 1869, p. 130).

With *Lasius fuliginosus* at Knowle (Ellis, Ent. Rec., 1908, p. 57).

Homalota oblongiuscula, Sharp.

Taken by Dr. Power at Mickleham with *Lasius fuliginosus*.

Homalota exarata, Sharp.

"A few specimens found by Dr. Power and Mr. Brewer in Tilgate Forest in the nests of *Formica fuliginosa* are all I have seen" (Sharp, *l. c.* p. 187).

This species is treated as a synonym of *hepatica*, Er., by Ganglbauer and the last European Catalogue. With what reason we know not, as Sharp includes both species in his monograph. These are all the records I can find of the last three species with ants.

Homalota sodalis, Er.

I have taken this species on several occasions in nests of *Formica rufa* at Weybridge between 1896 and 1908, and with the same ant at Oxshott in 1907. *H. myrmecobia*, Kr., which comes next to it in Ganglbauer (ii, p. 186), is recorded by him with *F. rufa* and *pratensis*.

Homalota analis, Gr.

This little species, which is very abundant and widely distributed throughout the kingdom, is frequently found with ants. I have found it in nests of *Formica rufa* at Weybridge in plenty, Oxshott, etc., with *F. exsecta*, not uncommon at Bournemouth, and with a *Myrmica* at Porlock. Mr. Day records it with *F. rufa* from Keswick.

Lamprinus saginatus, Gr.

"At roots of grass and in moss in damp places, especially heaths; it has occurred in ants' nests in France" (Fowler, *l. c.* p. 198).

It has been recorded with *Lasius flavus* and *Myrmica ruginordis* at Tubney and with *Formica fusca* in the New Forest (Walker); with *Poncra contracta* at Charing (Chitty); and in moss with ants at Lundy Island (Joy). I have taken it in a nest of *Formica sanguinea* at Weybridge. This species is regarded as truly myrmecophilous on the Continent, though apparently not in Britain, so it must be dealt with in this paper. Most of our captures are in moss and at roots of grass. I suspect often with ants, or in the neighbourhood of their nests, though not so recorded. Wasmann gives as its hosts, *Myrmica lacvinodis, ruginodis* and *scabrinodis, Formica rufa* and *Lasius fuliginosus*. He has found the larvae in the nests and has kept the beetle in his observation nests. He shows that it eats the ants' eggs, and that its shape protects it from its hosts when attacked (Zeitschr. für wissenschäft, Insectenbiologie, 1905, p. 420). This perhaps shows us how a *Tachyporus* species living in the neighbourhood of ants' nests might eventually become a myrmecophilous insect.

Heterothops quadripunctula, Brit. Cat. (nec Gr., *nigra*, Kr. ?).

"In haystack, flood and other refuse; also occasionally in nest of *Lasius fuliginosus*" (Fowler, *l. c.* p. 225).

Harwood took it with *Formica rufa* at Colchester. I have taken it with the same ant at Weybridge, and on several occasions with *Lasius fuliginosus* at Wellington College. I am not quite satisfied if the species I have taken with ants is the same as *H. nigra*, Kr., which Dr. Joy has shown is abundant and widely distributed in moles' nests. My specimens appear to be a little larger, and the puncturation more alutaceous, and consequently less shining. In any case it shows a tendency towards the myrmecophilous habit.

Quedius mesomelinus, Marsh.

I once took this common insect in plenty in a nest of *Lasius fuliginosus* at Chiddingfold, and sparingly with the same ant at Oxshott. Mr. Ellis found an injured specimen in a nest of *Formica rufa* at Knowle. I have shown by experiment it was unable to protect itself when introduced into nests of *Formica rufa*. *Quedius brevis* is a purely myrmecophilous beetle, occurring with both the above ants; *Quedius microps* has been recorded with the former by Crotch, and abroad, *Quedius puncticollis* occurs in wasps' nests, and Joy has shown that *Q. longicornis* and *vexans* are inhabitants of moles' nests. We can easily imagine a descendant of *Quedius mesomelinus* as an ants'-nest species.

Staphylinus stercorarius, Ol.

The following records of this widely distributed species occurring with ants are to be found. Bold recorded taking a fine series in the nests of a *Myrmica* at South Shields (Col. North. and Durham, 1871, p. 37).

Walker took it on several occasions with *Myrmica ruginodis* at Rannoch, and I have found it with *Lasius flavus* at Blackgang and Sandown, Isle of Wight, and with *Myrmica scabrinodis* near the Forth Bridge. Although generally found away from ants, these cases point to a distinct tendency to inhabit ants' nests. Fowler also records *Staphylinus latebricola* as sometimes in company with *Formica rufa*.

Othius myrmecophilous, Kies.

"In moss, dead leaves, etc., sometimes, as its name implies, in company with ants (*Formica fuliginosa*, etc.), but this is by no means always the case, and in fact appears

to be rather the exception than the rule" (Fowler, *l. c.* p. 296). It has been taken with *Formica rufa*, at Knowle and Bewdley (Ellis); Corbridge-on-Tyne (Bagnall); I have taken it with the same ant at Weybridge and Oxshott, with *Lasius fuliginosus* at Tilgate Forest, Walton, and Wellington College, with *Formica exsecta* at Bournemouth, and with *F. sanguinea* at Nethy Bridge, Inverness-shire. I am inclined to think it occurs more often with ants than is supposed, and that it has made considerable steps towards becoming a true ants'-nest dweller. Ganglbauer records it sometimes with *L. fuliginosus* and *F. cougerens.*

Leptinus testaceus, Müll.

As this little blind beetle has been taken in the nest and runs of *Lasius fuliginosus* at Mickleham (Rye), Tilgate Forest (Champion), and Guestling (Collett), it must be mentioned here. It occurs more frequently in nests of bees, birds, moles and small rodents.

Father Wasmann writes of the *Scydmaenidae*—"Many species of this family are occasionally ants' guests, without belonging regularly to their company. Proportionately few are strongly myrmecophilous. The food of the *Scydmaenidae* appears to consist chiefly of mites. Their ant-like appearance ('Ant-beetles,' Müller and Kunze) has perhaps at best a biological signification in the larger *Scydmaenia*, whether on account of protection from insect feeders, or for intercourse with ants is not yet known."

Scydmaenus godarti, Latr.

"Under bark, in rotten wood, in company with ants; rarely under dead leaves; Buddon Wood, Leicestershire, in nests of *Formica rufa;* Sherwood Forest, in rotten wood, with ants" (Fowler, iii, p. 77).

In April 1905, Messrs. Bouskell, Chitty and I, all found it in nests of *Formica rufa* at Buddon Wood. The specimens taken by Bouskell and myself were in the centre of a nest, running about quite at home in the midst of the ants, and moving the antennae rapidly in true myrmecophilous manner. The ants paid no attention to them. I consider this species is practically established here as an ant guest.

Scydmaenus pusillus, Müll.

It has been recorded with *Formica rufa*, at Buddon

Wood (Fowler), Stoke Wood, Devon (Parfitt); and I have taken it with *L. fuliginosus* at Tilgate Forest. Both this species and the last seem to be rare on the Continent and are not recorded with ants.

Euthia plicata, Gyll., has also been recorded from ants' nests here, and Ganglbauer writes "also in nests of *Formica rufa* and *exsecta*." I am inclined to doubt if many of the British records are the true *plicata*, Gyll., at all.

Trichonyx sulcicollis, Reich.

It was taken by Douglas and Scott in old elm stumps at Lee in company with ants, but most of the records in this country appear to be away from ants. Mons. Bedell records it with *Ponera contracta* near Paris, and Herr Reitter with *Lasius brunneus*. Our other species, *T. märkeli*, is almost always taken with ants, and I suspect that this species also is truly myrmecophilous.

Ptenidium turgidum, Th., and *P. gressneri*, Er., have both been recorded with ants. Fowler writes of the former, "in rotten wood, usually in company with ants," and of the latter, "in rotten wood, chiefly in company with *Formica fuliginosa*." I have taken *gressneri* in a nest of *Lasius fuliginosa* in Sherwood Forest, but both these species are much more generally found away from ants.

Hister marginatus, Er., was taken by Harwood with both *Formica rufa* and *Lasius fuliginosus* at Colchester. Dr. Joy, however, has shown it is a moles'-nest species, where it is often abundant, and widely distributed.

Dendrophilus punctatus, Hbst.

"In dead animals, rotten wood, etc., and also in the nests of *Formica fuliginosa*" (Fowler, iii, p. 207).

Janson recorded it with *F. rufa* (Ent. Ann., 1857, p. 95). I took it with the same ant at Weybridge, and have bred it out of my observation nests of *Lasius fuliginosus* from Wellington College, and *Formica exsecta* from Bournemouth. It is frequently found in birds' nests; Joy treats of it in his Class B (those species which are commonly found in the nests and breed there, but also are found and breed elsewhere), and writes (E. M. M., 1906, p. 246), "found in almost any old nest, even if it is quite dry."

Wasmann gives *Lasius fuliginosus* as its host, and writes, "Although this species is often taken also in hornets' nests, in earth, etc., I still hold it in preference as myrmecophilous." *Dendrophilus pygmaeus* is purely myrmecophilous; the hardness of the body in the *Histeridae* protect them from the attacks of the ants, and it is evident that a certain number of species are experimenting in a myrmecophilous life.

Abraeus globosus, Hoffm.

"In rotten wood of beech, ash, etc. . . . Mickleham, in nests of *F. fuliginosa*" (Fowler).

Crotch recorded it as not rare with *Lasius fuliginosus* at Weston-super-Mare, but most abundant in Cambridgeshire, and he writes, "Though I have no doubt this species is a truly myrmecophilous insect, it has a great partiality for fungus" (Zool., 1862, p. 8140).

Kraatz recorded it with *Formica rufa* (Stett. Ent. Zeitz., 1851, p. 170), and Von Hagens with *Lasius brunneus* (Berl. Ent. Zeitschr., 1855, p. iii). Perris described the larva of this species from a nest of *Lasius fuliginosus* (Ann. Soc. Linn. Lyon., xii, 1876, p. 16).

It is much more frequently found in rotten wood away from ants; I have taken it in rotten trees in the New Forest, Tewkesbury and Enfield, but never with ants. If it were not for the records with *F. rufa*, etc., one might imagine that *Lasius fuliginosus* had selected a tree already occupied by the beetle, but even so, this might represent the beginning of a myrmecophilous life.

Cetonia aurata, L.

This species is only occasionally found with ants. Indeed, Father Schmitz, in a paper on "Some Traditional Errors in Zoological Literature" (Natur *u.* Offenbarung. Band 54, 1908, p. 99), points out that the larvae of *Cetonia aurata* is repeatedly quoted as living in the nests of the wood ant, when really *Cetonia cuprea*, F. (*floricola*, Hbst., *aenea*, Gyll.), is intended, and that Wasmann has only found the former on one or two occasions with ants. The following genuine records, however, occur here.

Janson recorded the larvae with *F. rufa* (Ent. Ann., 1856, p. 151); F. Smith writes, 'I have found the *Cetonia aurata*

in nests (of *F. rufa*) which I have met with in Yorkshire" (Trans. Ent. Soc. Lond., 1844, p. 101).

Shipp recorded (E. M. M., 1892, p. 288) finding two coccoons in a nest of the wood-ant on Shotover Hill, near Oxford, and on opening one of them he found a perfect insect in it.

Professor Poulton took several larvae and a perfect insect in a nest of *Formica rufa*, in the New Forest, which he sent to me, and I introduced them into my observation nest of that ant, and bred perfect insects from these larvae. (See "Myrmecophilous habits of *Cetonia aurata*," Ent. Rec., 1904, p. 301.) *Cetonia floricola* is truly myrmecophilous in its early stages, and I think the study of *C. aurata*, when found with ants, shows us exactly how the former became so. These beetles are too hard for the ants to injure, the skin of the larvae also is too tough, and they brush off the ants by burying themselves in the débris of the nest when attacked, as I have shown. With *floricola*, Mr. Lloyd recorded that when at Rannoch, he had exposed their larvae, they were fiercely attacked by the ants. (E. M. M., 1892, p. 310).

There are of course other records of non-myrmecophilous Coleoptera with ants, most of them no doubt of chance occurrence, but some more frequently, still enough has been written here to illustrate our subject. In conclusion I should like to say that I am collecting all the British records of species found with ants, and shall be much obliged if any one can tell me of any of those species mentioned here which I have omitted.